Bridge Load Limitation (Short Tons)	Type of Vehicle & Tare Weight (Short Tons)	Net Pay Load (Short Tons)
8 and above	ZIL-150 (4x2) -- 4.3	4.0
5 - 8	GAZ-63 (4x4) -- 3.6	3.0
	GAZ-51 (4x2) -- 3.0	3.0
Less than 5	GAZ-51 (4x2) -- 3.0	2.0

f. The known or estimated bridge capacity limitations for each road sector are shown on Map 1.

III. Railroads:

A. General

1. South China's railroads are militarily significant largely because they provide the best means of relatively rapid land transportation over long distances. Within the study area, lines in operation form two indirectly connected rudimentary networks traversing for the most part mountainous terrain.

2. The major, standard gage (4' 8½") network has as its principal axis the extension of lines leading south from Shanghai and Hangkow from their merging point at Heng-yang to the Communist China-North Vietnam border region at P'ing-hsiang. From this general axis, four important lines treated in this study diverge southeast to Hsia-men (Amoy), southeast to Kuang-chou (Canton) and Hong Kong, northwest to Kuei-yang, and southeast to Chan-chiang (Fort Bayard). The standard gage line also connects with the Vietnamese meter gage line and involves transloading at P'ing-hsiang.

3. The minor, meter gage (3' 3-3/8") network extends to the southeast from K'un-ming to the Communist China-North Vietnam border at Lao-kay (Ho-k'ou on the Chinese side), where it connects with the Vietnam Railway System.

4. Both networks have numerous minor spurs which, except for the Mao-ming - Lien-chiang line, are not covered in this study. These spurs consist mainly of either industrial access lines or finished portions of projected connecting lines now undergoing conversion or initial construction.

5. Of the lines treated, the Heng-yang - P'ing-hsiang, the Heng-yang - Kuang-chou (Canton), and the K'un-ming - Ho-k'ou lines are chiefly or entirely of pre-World War II construction, while the three remaining lines and the Mao-ming spur are chiefly or entirely of post-1948 construction.

6. The condition and efficiency of railroads in South China are not known accurately. But two generalizations may be made: 1) the standard gage system probably is in better overall condition and more efficiently operated than the meter gage system, and 2) except for the Heng-yang - Kwang-chou (Canton) and possibly the Liu-chou - Hsia-men (Amoy) lines, the standard gage system probably is inferior in condition and operating efficiency to principal lines in east-central and northeast China. Although Communist China reportedly has made significant overall progress and improvement during the past decade in its railroad plant and its operation, in general, operations are hampered by: 1) light, overage track construction, 2) inadequate maintenance, 3) insufficient and widely spaced passing tracks, 4) insufficient double tracking, and 5) generally inadequate and/or insufficient motive power and rolling stock inventories. All of the foregoing shortcomings either exist or their effects are felt on the lines included in this study. However, steady progress for the foreseeable future toward elimination or amelioration of these deficiencies may be expected.

B. Considerations and Assumptions

1. Significant differences in railroad capacity estimates would result on some of the lines treated if direction of movement were reversed, particularly for those lines having steep gradients.

2. Alterations in physical characteristics and the effect of such changes on capacities estimates caused by military interdiction cannot be determined and therefore are disregarded.

3. Since this study is concerned with capacities rather than capabilities, no consideration is given to motive power or rolling stock inventories or equipment availability per se. On the other hand, characteristics of rolling stock and the operating weights and tractive effort-outputs of motive power that might be used on South China rail lines were determined from an examination of available data. In this connection, insofar as is known, diesel equipment currently is not in use on the lines treated. However, diesel equipment could be used advantageously on the higher gradient lines if appropriate maintenance and service conversion measures were taken.

4. Because the effects of terminal facilities on goods movement are of such nature and magnitude as to require separate, detailed study, no consideration is given to this question.

5. Entirely different capacity estimates would result if average train speeds or other operating conditions were not essentially those utilized herein.

6. Accompanying railroad capacity estimates are for lengthy point-to-point sectors. A paucity of information made it impossible to reflect characteristics and their effects on capacity estimates for the intermediate segments delineated by places named in the accompanying tables.

7. Sector termini were determined by: 1) physical characteristics of the route in question, and/or 2) junction points, to show through mileages and capacity estimates over different routes.

8. Climatic conditions in South China vary widely for various parts of the region. Heavy rainfall, which generally prevails from May through September, may cause landslides, inundations, and/or bridge and road bed washouts in localized areas, interrupting railroad operations for a period of hours or even days.

9. Railroad bridges tallied on Map 2 reflect the best information available. It should be noted that many serious information gaps are reflected in these data.

C. Characteristics of Selected Routes

1. The characteristics of railroads treated in this study are shown in Table 3. In its preparation all intelligence data available by the 1 Oct 61 cut-off date were utilized. Critical information gaps were bridged unwillingly by arbitrary estimates, since a complete lack of information was found to exist in some instances. This lack prevented the making of weighted estimates from intelligence data.

2. Mileages shown represent conversions of kilometerage contained in Communist Chinese railroad timetables with the exception of the Mao-ming spur line. In this instance the distance was scaled from the AMS Map, Series L500, Scale 1:250,000.

3. Railroad alignments for the pre-World War II lines were obtained from AMS Maps, Series L500 and L509, Scale 1:250,000. Post-1948 line alignments generally were derived from collated use of

Communist Chinese timetables and the cited AMS maps.

4. Rail line place names within sectors generally were selected to reflect important communication centers and/or significant changes in terrain or cultural features.

D. Optimum Capacities of Selected Routes

25X1C

[redacted]

2. Capacity estimates, determined for north to south movement, are termed optimum for the reason that no allowance is made for the operation of "overhead," or support role, trains. Thus, the entire train density EWPD has been considered devoted to movement of military cargo. On the other hand, by increasing available tractive effort, or varying other conditions, even greater tonnages could presumably be moved across the lines. Therefore, the term maximum capacity purposely was avoided.

3. The number of trains EWPD is determined by application of the following equation:

$$N = 1/2 \frac{1440}{RT + DT} \text{ (EF) where:}$$

N = train density in number of trains EWPD

1/2 = conversion to one way operation

1440 = number of minutes in 24 hours

RT = running time in minutes over greatest distance between sidings

DT = delay time in minutes incurred in waiting at sidings for arrival of oncoming train

EF = efficiency factor reflecting routine operating delays according to the following types of signalling used:

0.50 - telephone, ticket, and other rudimentary signalling

0.60 - manual block operations

0.75 - automatic signalling

0.85 - centralized train control

Delay times at sidings value, when not identified as being estimates, were collated from Communist Chinese passenger train timetables, after seeking to allow for customary differences between passenger and freight train operating practices.

4. Net tonnage of military trains is obtained by using 55% of the gross trailing load. The gross trailing load is determined by arriving at selected tractive effort values and locomotive operating weights and calculating what tonnage these locomotives would be capable of hauling over the ruling grade at customary military train speeds through application of the following equation:

$$GTL = \frac{TE}{TR + GR} - W \text{ where:}$$

GTL = gross trailing load in short tons

TE = locomotive tractive effort in pounds

TR = train resistance in pounds/short tons

GR = grade resistance in pounds/short tons

W = operating locomotive weight in short tons

5. Motive power and rolling stock factors utilized in this study are:

a. Collated Locomotive Factors

	Tractive Effort (Lbs)	Operating Weight (S/T)	Overall Length (Ft)
Standard Gage (4' 8½")	45,000	200	70
	35,000	160	60
Meter Gage (3' 3-3/8")	25,000	105	50

b. Train and Grade Resistance Factors

	Train Resistance (Lbs/ST)	Grade Resistance (Lbs/ST)
Standard Gage (4' 8½")	3.0	20
Meter Gage (3' 3-3/8")	3.1	20

c. Collated Rolling Stock Factors

	Predominantly 4-axle car trains		Equally mixed 4 & 2-axle car trains	
	Length Coupling to Coupling (Ft)	Usable Capacity (S/T)	Length Coupling to Coupling (Ft)	Usable Capacity (S/T)
Standard Gage (4' 8½")	40	40	-	-
Meter Gage (3' 3-3/8")	-	-	25	18

(1) Because the above data is required to adjust train lengths to siding lengths, the meaning of the term usable capacity differs from rated capacity in a theoretical sense only. Rated capacity wastage resulting from the loading of odd-shaped and high or low density military supplies has been allowed for in the 55% factor used to determine net train load. Therefore, when adjusting train lengths to siding lengths the rated capacity statistically may be considered equal to the usable capacity.

(2) In addition to the siding footage occupied by the locomotive, 150 feet of end clearance (75 feet on either end of a passing loop) has been allowed in adjusting train lengths to siding lengths. Hence, siding footage available to payloaded cars is total siding length minus locomotive length minus end clearance footage.